December 2003

RESPONSE SUMMARY TO PUBLIC COMMENTS CONCERNING THE MERCURY TMDLS FOR THE MCPHEE AND THE NARRAGUINNEP RESERVOIRS

The Water Quality Control Division received several comments in response to the dissemination for public comments of the Draft Total Maximum Daily Loads document for Mercury for the McPhee and the Narraguinnep reservoirs. The comments have been organized and grouped in categories. The Division's responses address the categories of comments in general, although some responses may address a specific comment. At the end of the document there is a key explaining the abbreviations for the entities providing comments. The following is the summary of comments and associated responses:

A) Comments related to whether McPhee and Narraguinnep reservoirs were appropriately included in Colorado's section 303(d) list of impaired waters.

1) The TMDL should make clear that the 303(d) listing of the two reservoirs is based on a draft fish advisory for elevated levels of mercury in some large piscivorous fish in the two reservoirs, not the quality of the water in the Two Reservoirs. *(SWCD)*

2) The use of the two reservoirs as a fishery is protected by current standards, but the standards for such protection need to be reconsidered. The TMDL should emphasize that the 303(d) listing of the Two Reservoirs is based on EPA's opinion that a water body for which there is a fish advisory does not meet the Clean Water Act's "fishable" standard, even though the water quality meets the adopted standards for fish consumption. *(SWCD)*

3) … it is explained that the TMDL for the Two Reservoirs was EPA initiated under the Clean Water Act "fishable" clause. To the best of our knowledge, there was no CWQCC officially accepted policy in 1998 that fish consumption advisories should trigger a 303(d) listing and a subsequent TMDL. The 1998 303(d) list includes specific criteria used for listing decisions. No criteria refer to fish consumption advisories, yet a few segments are listed on that basis. *(SWCD)*

4) It is questionable whether the Two Reservoirs should have ever been listed under Clean Water Act § 303(d) because the State's adopted water quality standards are not being exceeded. The water column standard of 0.01 ug/l is the Colorado water quality standard set to prevent the U. S. Food and Drug Administration's (FDA) action level of 1 ppm occurring as a fish flesh concentration. See CWQCC Regulation 31 at Table III, footnote 6 for the rationale of setting the water column concentration at 0.01 ug/l in order to protect the average consumer against fish flesh concentrations exceeding FDA action levels. The CWQCC specifically stated in that footnote that for sensitive populations, fish flesh concentrations as low as 0.2 ppm, as compared to the 1 ppm concentration, may pose a health risk. The footnote recognizes the opportunity to set site-specific standards. No site-specific standard was set for the Two Reservoirs to protect against the 0.2 ppm fish flesh concentration. *(SWCD)*

5) The TMDL is explained … as EPA-initiated under the "fishable and swimable" clause. We do not think that Colorado intended in 1998 for fish consumption advisories to trigger a TMDL. *(SWCD)*

6) Colorado has no clear criteria for listing water bodies as impaired on the basis of fish flesh. Indeed, the CWQCC just adopted the listing methodology to be used for the 2002 listing process. It states simply that the presence of a fish consumption advisory issued by the state will result in a review of the waterbody under the listing criteria. *(SWCD)*

This RESPONSE generally addresses the issues raised in section A:

The Reservoirs were placed on the 1993, 1994, 1996, 1998 and 2002 Colorado lists of impaired waters based on a fish consumption advisory that indicated potentially dangerous levels of mercury in fish tissue. Those decisions were based in part on 1992 EPA guidance recommending that water bodies for which a fish consumption advisory had been issued should be included on the section 303(d) list. More recently, EPA on October 24, 2000 issued further guidance specifically addressing listing decisions relating to such water bodies.

As discussed in EPA's 2000 guidance, section 101(a)(2) of the Clean Water Act establishes as a national goal "water quality which provides for the protection and propagation of fish, . . . in and on the water wherever attainable." These are commonly referred to as the "fishable/swimable" goals of the Act. EPA and the Division consider "fishable" to mean that not only can fish thrive in a waterbody but, when caught, can also be safely eaten by humans. This interpretation also satisfies the CWA section 303(c)(2)(A) requirement that water quality standards protect human health. Colorado's listing decisions have always been intended to protect the beneficial uses of the surface waters of the State, including human health-related uses.

In 2002, a revised methodology for including waters on the 303(d) list specified that the presence of a fish consumption advisory will result in a review of the waterbody using all relevant criteria. The State is required to consider all existing and readily available information to identify impaired watebodies. Fish consumption advisories are such information and properly formed the basis for listing the Reservoirs. In any event, once the Reservoirs were listed, they must be the subject of a TMDL. The current process is preparation of the TMDL, not a reevaluation of whether the reservoirs should have been listed as impaired over the last ten years. In addition, based on the settlement of a lawsuit alleging deficiencies in Colorado's TMDL program, preparation of a TMDL for the Reservoirs must be completed at this time.

B) Comments related to State of Colorado's and/or EPA's interpretation of water quality standards.

1) A water quality standard for mercury to protect fish consumption cannot be changed by a fish consumption advisory into a target to determine necessary mercury reductions. Rather, the advisory triggers standards revisions and target setting by the Commission. *(SWCD)*

2) … only the adopted numeric standards of the Two Reservoirs are relevant to the 303(d) impairment issue. The water quality of the Two Reservoirs complies with the standards and the uses of the Two Reservoirs are deemed protected by those standards until they are changed. Since they have not been changed, attainment is occurring. There is no authority to deem the use as impaired despite the attainment of the numeric standards merely because of an alternative risk analysis by an unauthorized agency. *(SWCD)*

3) In spite of the numeric standard, because of the Fish Advisory and without explanation, the Two Reservoirs have been deemed "impaired" based upon an interpretation of the narrative standards at 31.11(1)(1), i.e., "free from toxics." 31.11(1). The Basis and Purpose Statement of the Basic Standards Regulation #31, at 5 CCR 1002-31 page 100, limits the application of such interpretation to only an individual discharger. Targets and TMDLs are broadly applicable to all sources. There is no authority to interpret a narrative standard to determine a target and a TMDL. *(SWCD)*

4) There is no authority to interpret a narrative standard when there is a specific numeric standard for the protection of human health. Indeed, interpreting the narrative standards is limited by #31.14 (4) to the actual issuance of permits when there is no numeric standard: where no statewide or site-specific numeric standard exists for a constituent of concern, the Division may establish effluent limitations or other permit conditions for such constituent if necessary to comply with the narrative standards in Section. *(SWCD)*

5) The Phase 1 TMDL serves as a Use Attainability Analysis which will result in further data collection, but should also result in a Colorado Water Quality Control Commission ("CWQCC") rulemaking hearing to replace, if justified, the risk assessment of the current standards and to set appropriate site-specific water column concentrations and the targets for fish flesh upon which any loading reductions can then be based. *(SWCD)*

6) There is no authority under Regulation #31.14(4) in the Division to adopt a target based upon the narrative standard when there is an existing numeric standard designed to protect that use, nor to adopt a target applicable to other than a specific discharger. *(SWCD)*

7) The targets for determining the loading reductions in the TMDL are based upon an interpretation of the "free from toxics" narrative standard, using EPA's human health methodology to derive an acceptable fish flesh threshold. No prior public process for translating this narrative into TMDL targets has occurred. Rather, this TMDL represents the public process for that site-specific translation. The Division lacks authority to interpret the narrative independently of the Commission or to set targets in conflict with the Commission's adopted water quality standards. *(SWCD)*

This RESPONSE generally addresses the issues raised in section B:

Narrative criteria are descriptions of the conditions of the waterbody necessary to attain and maintain its designated use, while numeric criteria are values expressed as levels, concentrations, toxicity units or other measures which quantitatively define the permissible level of protection. Colorado standards currently provide for both narrative and numeric standards (Basic Standards Reg 31). In certain circumstances it is possible that numeric water quality criteria can be met, and the designated uses still not be achieved. For example, factors such as food web structure, the concentration of dissolved organic carbon in the ambient water, and accumulations in the sediment may affect uptake of mercury into fish flesh on a site-specific basis. In these circumstances, EPA recommends State and Authorized Tribes translate the applicable narrative criteria on a site-specific basis, or adopt site-specific numeric criteria, to protect designated uses. However, ultimately, the final determination of whether the water quality standard is attained is made by determining the attainment of the designated use. The WQCD is appropriately turning to the narrative criteria to account for the unique site-specific conditions of the Reservoirs as they affect the methylation and uptake of mercury into the food chain, and ultimately, affect human health.

The Division of Water Quality Control has determined that the reservoirs contain levels of mercury at levels that are harmful to humans who consume fish from the Reservoirs. Therefore the WQCD has concluded that the Reservoirs exceed Colorado's narrative water quality criterion for toxic pollutants. Based on that conclusion, the reservoirs were listed as impaired bodies of water, in the CWA Section 303(d) list. The WQCD and /or EPA have the authority to establish a TMDL to address that impairment. Congress did not limit the term "applicable water quality standards" in CWA section 303(d)(1)(C) to standards based upon numeric criteria, see in 40 CFR section 130.7(c)(1) ("TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numerical WQS").

CWA section 303(d)(1)(C) and 40 CFR 130.7 require the State to establish TMDLs at levels necessary to attain and maintain all applicable water quality standards. Under EPA's regulations, Colorado's listing of impaired waters must address numeric criteria, narrative criteria and waterbody uses. 40 CFR 130.7(b)(3). There is no distinction for this purpose between narrative and numerical standards. The TMDL must address all pollutants that prevent attainment of each type of standard. Narrative and numeric (whether Basic or site-specific) criteria are complementary and must both be satisfied in order to protect classified uses. This TMDL applies the narrative criteria to a site-specific set of circumstances that have resulted in a threat to human health.

Regulation 31.14(4) requires integration into discharge permits of conditions necessary to maintain and attain basic, narrative and numeric standards so that all discharges to state surface waters protect classified uses. Nothing in that subsection prohibits permit conditions intended to address narrative standards even where a numeric standard exists. Neither is there any limitation in that section precluding development of a TMDL to satisfy a narrative criterion simply because a numeric standard also exists.

Preparation of a TMDL to meet a narrative criterion does not implicate public participation requirements applicable to adoption of water quality standards. Rather, the TMDL process includes public notice and comment procedures specific to this function. Part of the Division's responsibility and authority under Colorado law is to implement the standards and programs adopted by the Water Quality Control Commission, including TMDL preparation. This TMDL does not impinge on the authority of the Commission granted by state law. The public participation process in this case complies with 40 CFR 130.36.

C) Comments related to whether Fish Consumption Advisories have legal authority in Colorado.

1) … the Colorado Health Department has maintained a "Fish Consumption Advisory" for the Two Reservoirs, but has not requested that the Colorado Water Quality Control Commission (CWQCC) revise the numeric standard, even though the CWQCC is the state agency designated for all purposes of the federal Clean Water Act (CRS § 25-8-202(6). This includes setting water quality standards based upon science and policy, including the Colorado Department of Health fish advisory. We are not aware of any statutory or regulatory authority for the issuance of such a fish advisory by the Colorado Department of Health. *(SWCD)*

2) The use of Fish Consumption Advisories is not specified as "credible evidence" for biological information "demonstrating numeric or narrative standards violations, use impairment or a declining trend in water quality or biotic community. . ." The draft 1991 Fish Consumption

Advisory specifies the specific number of meals per month at suggested tissue concentrations from 0.2 ppm to 2.8 ppm or more and the allowable meals per month for non-pregnant adults and pregnant women. No specific range is specified for Colorado as the threshold of unacceptable risk. Nothing is said in the Advisory about species specific testing or about whether measurement of exceedance of a threshold is to be based upon a single fish fillet, an average of some minimum number of fillets, a weighted average of all sport fish or other median or mean. It does not appear that the ranges are daily doses (unlike Wisconsin) but are based upon chronic exposure. Accordingly, some method of averaging is assumed. Yet none of the evidence used to make the initial listing of the water quality of the Two Reservoirs as impaired is produced to demonstrate that the average of the data shows exceedance of the criteria in the range between 0.2 ppm and 2.8 ppm, nor is a selection made of a threshold within that range. To reconcile the evidence of biological impairment with the evidence of compliance with the numeric standards intended to protect the same use, the water quality standards need to be reconsidered in a public process and the targets for measuring reductions in loading must be set thereafter. Ultimately, this is a risk analysis based decision to be made after public notice and hearing by the CWQCC. *(SWCD)*

3) The Two Reservoirs are listed as not supporting designated uses based on the presence of a fish consumption advisory, rather than deviations from ambient water quality standards for mercury. We do not believe that the fish consumption advisory was reviewed by the CWQCC in the same manner as are water quality standards, either as a rule or after public notice and comment, and, in fact, the Advisory has not had any public review or CWQCC approval. Therefore, the use of a fish consumption advisory as a trigger for a TMDL adds uncertainty in the development of the TMDL. The fish advisory has triggered a Use Attainability Analysis that may result in revised water quality standards by following Phase 2. Under Phase 2, the fish consumption advisory should be submitted to the same review and approval process as is used for other water quality standards, and the standards should be subject to a public reconsideration with a full risk analysis. Then, the target for the TMDL might need to be revised. *(SWCD)*

4) Fish consumption advisories in Colorado have no legal authority. The TMDL should discuss the relationship of the Colorado Department of Health and Environment's (CDPHE) issuance of fish advisories and the CWQCC's adoption of water quality standards based upon alternative risk assessments of human consumption of fish flesh. These sister agencies appear to be in conflict. The CDPHE does not have authority to act contrary to the regulations of the CWQCC. The Division, as a unit of the CDPHE, should have recommended to the CWQCC that the adopted segment specific standards for mercury be revised if the Advisory deemed them unprotective of human health. That was not done, but is what needs to be done. *(SWCD)*

5) Changes in the basis for Fish Consumption Advisories and the State Water Quality Standard for Mercury are required. The public health issue is whether advisories and standards for the eating of certain fish should be based on the highest concentrations of mercury found in a single fish species, or an average of concentrations in all fish or a weighted average of the fish consumed. Using 15-inch small mouth bass as the target species in McPhee Reservoir, and 18-inch walleye as the target species in Narraguinnep Reservoir is overly conservative. Using a weighted average of creel data in the Two Reservoirs would more closely reflect what people are catching and eating from the Two Reservoirs. This corresponds to the CDPHE, "Position Paper for Draft Colorado Health Advisory for Consumption of Fish Contaminated with Methylmercury" revised May 6, 1991. It states that it is intended for people who are chronically exposed. Thus, a single meal of one fish is not a hazard. A weighted average reflects consumption risks over time. This is also consistent with the CWQCC 's "Human Health-Based

Water Quality Criteria and Standards Policy 96-2" and its provision that human health criteria are lifetime, exposure-based criteria measured on the basis of an average of all samples collected in a 30-day period. Realistically, the current advisory is a trigger for reconsidering the current water quality standard, and setting a new mercury standard only if necessary to translate fish flesh concentrations into appropriate water quality standards. *(SWCD)*

6) Proposing a concentration of 0.5 ug/g does not concede the appropriateness of this concentration. Appropriateness is determined in a rulemaking process after a full discussion and a better understanding of the basis of this concentration from a human health risk assessment perspective. *(SWCD)*

7) … the 0.5 ug/g fish flesh mercury threshold amount has had neither public review and comment nor CWQCC approval as a formal standard to replace the 1 ppm FDA action level referred to in footnote (6) of the Basic Standards in the adoption of a site-specific water column standard. The 0.5 ug/g amount is used as the target level for mercury concentrations in fish tissue in two species of large piscivorous fish in the Two Reservoirs. This target is subject to the adoption by the CWQCC of revised water quality standards reflecting the lower fish flesh threshold and the related water column concentration. *(SWCD)*

8) This listing of the Two Reservoirs as impaired occurred on the basis of the CDPHE's issuance of a "fish advisory", as described in the Position Paper for Draft Colorado Health Advisory for Consumption of Fish Contaminated with Methylmercury, May 6, 1991. There is no evidence that this draft advisory was ever finalized by staff or adopted by CDPHE after notice and opportunity to comment nor that it would preempt the adopted Water Quality regulations of the CWQCC. This advisory is applicable to all state water bodies where concentrations of mercury in fish flesh (fillets) are equal to or exceed the action level of 0.5 ug/g (wet weight) total mercury to protect sensitive populations. This action level is more restrictive than the 1 ppm action level of CWQCC regulation #31. To our knowledge, no CWQCC rule-making activity created this lower action level. *(SWCD)*

9) … provide documentation of final, official action by the CDPHE to establish specific fish tissue concentrations from a range of concentrations, as causing an unacceptable health risk as a risk assessment decision. The draft "Position Paper for the Colorado Health Advisory for Consumption of Fish Contaminated with Methylmercury" does not make that choice. It is not clear that a final document has made that choice. Section 2.3 of the TMDL states at page 2-2 that based upon the Table 2.1 in the Position Paper, a fish tissue concentration of 0.5 ug/g was established by the CDPHE as the approximate center of the range for safe consumption. That decision is not in the Position Paper. It is unclear how the CDPHE's Disease Control and Environmental Epidemiology Division position in 1991 is relevant now in light of the CWQCC's more recent "Human Health-Based Water Quality Criteria and Standards" Policy 96-2. That Policy at page 3 is explicit that Colorado's standards are applied as chronic standards with compliance assessment based on an average of all samples collected in a 30-day period. Thus, assessment based upon 2 out of 32 fish samples is in error. *(SWCD)*

10) Colorado does not have a formal regulation establishing a guideline for the issuance of fish consumption advisories due to the presence of mercury in fish tissue. Therefore, the listing is based on an informal assessment rather than a properly promulgated rule. *(FWQC)*

11) Colorado's fish consumption advisory action level of 0.5 mg/kg is a numeric interpretation of its narrative criteria. Colorado admits that it "does not have a formal regulation establishing a

guideline for the issuance of fish consumption advisories". This informal action level, however, was selected as the numeric target for the TMDL. The resulting "target" is an ad hoc water quality standard imposed without any regard for mandatory regulatory process. This numeric interpretation was not promulgated in accordance with either the Colorado Administrative Procedure Act or Section 303 of the CWA and therefore is legally flawed. Having failed to lay the proper foundation for developing a TMDL (i.e., identifying or developing valid water quality standards), the TMDL also is legally flawed. *(UWAG)*

This RESPONSE generally addresses the issues raised in section C:

The fish consumption advisory that formed the basis for listing the Reservoirs as impaired waters is not a rule or regulation within the meaning of the Colorado Administrative Procedures Act. The advisory has not been presented to the Water Quality Control Commission for formal rulemaking action, although the Commission approved the lists containing the Reservoirs. For the purposes of this TMDL issue, the regulatory action taken by the Commission was the adoption of Regulation 31, the Basic Standards and Methodologies for Surface Water. In adopting that regulation, the Commission acted pursuant to its authority under section 25-8-204, C.R.S.

State law assigns the responsibility of implementing Colorado's water quality program to the Division. That responsibility includes actions to achieve and maintain the standards promulgated by the Commission. In this instance, the Division issued the Fish Consumption Advisory because it concluded that the Reservoirs contain mercury at levels that are harmful to humans who consume fish from the waterbody. The Division intends to rely on the Advisory in taking further action to achieve and maintain the Commission's standards through establishing this TMDL.

Neither issuing the Advisory nor establishing the TMDL is a rulemaking action. The TMDL applies an existing standard of general applicability, in this case the state narrative water quality criterion, to determine measures appropriate to a specific receiving water. Regulation 31.11 dictates that state surface waters shall be free from substances attributable to human-caused point source or nonpoint source discharges in amounts, concentrations or combinations that are harmful to beneficial uses or toxic to humans. The Advisory and TMDL are individual measures to implement the Commission's rule and are not rules themselves within the meaning of the state Administrative Procedures Act.

D) Comments related to the potential of the TMDL to generate enforceable measures.

1) Phase I of the TMDL does not result in enforceable measures. The TMDL should clearly state that the Phase I TMDL estimates on loading reductions have no enforcement effect. This phase of the TMDL process is in the nature of a Use Attainability Analysis in accordance with 40 CFR 131.3 as a structured, scientific assessment of biological, chemical, physical and economic factors necessary to determine the proper characterization of water quality uses, standards and targets. This assessment is necessary because of the conflict between the risk assessments of the CWQCC and the CDPHE. Until the CWQCC determines appropriate action levels, fish tissue thresholds, water column concentrations, no target can be established that reflects a publicly made risk management decision. Until such a target has been established, no reductions in loadings can be determined. There can be nothing binding about the TMDL or its allocations because of the data gaps. *(SWCD)*

2) The lack of a site-specific revision to the numeric standards for mercury and the adoption of targets implementing the site-specific standards, as well as the large number of uncertainties of the Phase 1 results mean that neither CDPS nor any federal permits should be denied or issued with limits based upon this TMDL, without the concurrence of the discharger. *(SWCD)*

3) Because of the documented uncertainty in the Phase 1 conclusions, completion of the Phase 2 tasks is essential prior to any enforcement of this TMDL. *(SWCD)*

4) Anti-backsliding implications must be addressed. Interpretation of the narrative standard as authorized by Colorado Regulation #31.14(4) is for setting effluent limits, only. Creating TMDLs is not setting effluent limits. If TMDLs are the equivalent of setting effluent limits and such TMDLs are then subject to anti-backsliding requirements even though they are very preliminary, then no TMDL should be set until the data base and predictive modeling attain previously determined levels of acceptable certitude. Colorado has no such levels. If anti-backsliding constraints are deemed to apply to preliminary TMDLs, then the Division, Commission and EPA should address how final TMDLs can be less stringent, which may certainly be the case here, under the anti-backsliding regulations. *(SWCD)*

This RESPONSE generally addresses the issues raised in section D:

This TMDL does not independently establish effluent limits or other enforceable measures. This phase establishes estimates to be used to identify necessary monitoring and evaluation, but the allocations are not intended to be binding until the completion of Phase II.

A TMDL is not independently enforceable, at least against a point source, until implemented in a discharge permit, which also means that the TMDL does not independently set an effluent limit. This position is consistent with 40 CFR 130.32(c)(1)(ii), which requires inclusion in the TMDL of a schedule for issuing, reissuing or revising NPDES permits to include effluent limits consistent with the wasteload allocations in the TMDL. As a result, some of the concerns expressed in the comments, e.g., anti-backsliding, are not relevant within the context of this phase of the TMDL.

Phase I of this TMDL establishes estimates to be used to identify necessary monitoring and evaluation, but the allocations are not intended to be binding until the completion of Phase II.

E) Comments related to the appropriateness of the data used to develop this TMDL.

1) The Guidance [EPA's "Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 2, Risk Assessment and Fish Consumption Limits, Third Edition" (EPA 823-B-00-008, Nov 2000)] sets forth a "weighted average" chemical compliance approach that, if used, would appear to demonstrate no threat to the public health from the current fish flesh concentrations found in the sampling to date. *(SWCD)*

Response: The application of this approach to be protective of most populations would assign the 0.3 ug/g (Hg in fish tissue) recommended Total Residual Criteria to only trophic level 4 fish. Under this approach the waterbody would be considered impaired. The State has the discretion to use other scientifically defensible methods to derive protective criteria.

2) The Division selected a target small mouth bass and walleye average fish flesh concentration of 0.5 ug/g for each Reservoir based upon a prior human health methodology. No local data support the default national fish consumption amount assumed in applying that methodology. The Two Reservoirs may not even support fishing year round. There has been no clear demonstration that the default human health methodology is applicable to these remote water bodies. Indeed, EPA in its new methylmercury criteria (66 F.R. 1344, January 8, 2001), recommended that States develop criteria using local or regional data rather than default values, particularly consumption patterns. *(SWCD)*

Response: The Division has the discretion to use any scientifically defensible method to develop criteria. In this case, smallbass and walleye were chosen as the species of concern due to their abundance and preference in consumption by the population.

3) set forth on how many occasions fish tissue samples were collected. *(SWCD)*

Response: Fish tissue samples were collected in approximately 7 occasions, at both reservoirs, between 1988 to 1993.

4) Citations need to be added to the TMDL for certain Division statements. *(SWCD)*

5) In subparagraph 3, Section 7.2.2, when will core samples be forthcoming and who will take them? Again, please state the objectives, how they will be met and the methodology to judge whether they have any merit. *(SWCD)*

Response: This will be addressed in Phase II of this TMDL.

6) EPA's currently accepted practice for evaluation of fish tissue data is to calculate weighted average tissue concentrations to determine whether fish tissue action levels have been exceeded. The State failed to evaluate the fish tissue data by EPA's currently accepted practice, which resulted in skewed data and erroneous exceedances of the action level. *(FWQC)*

Response: See comment above. The EPA Criteria does not have to be adopted until 2005, and the State may use a more restrictive criteria. The calculated weighted average can only be used when consumption at trophic levels is known and then the state must determine consumption patterns at each trophic level.

7) The estimated mercury emissions from Four Corners contained in the Draft Phase I are incorrect. *(PNW)*

Response: The estimated emissions for the Four Corners are based on EPRI Emissions data that were provided to EPA. The sources include "An Assessment of Mercury Emissions from U.S. Coal Fired Power Plants", 2000 EPRI, Inc., the 1999 IRC data and the National Emissions Database.

8) The analytical methods employed by Tetra Tech to obtain results at such extremely low detection limits (10^{-9} - 1 ppt) are available at only a few commercial laboratories and such analyses are quite costly. *(WTC&A)*

Response: Just as a correction – 10^{-9} is the same as parts per billion, not trillion. The water column samples were analyzed at the ppb levels. This allowed the modeling of the resulting data

to determine reductions needed to meet the Fish Consumption Limits. This is the appropriate analysis utilizing the EPA approved method 1631.

9) The field collection and sample treatment require "Clean Hands/Dirty Hands" techniques in older to be compatible with such low limits of detection ("LLD"). This is a costly and cumbersome procedure, which, according to US Geological Survey protocols, requires two or more field personnel. *(WTC&A)*

Response: The low limits of detection are needed to measure the levels of mercury in the water column that result in exceedance of the Fish Consumption Limits. The Clean Hands/Dirty Hands technique is the accepted method for collecting water column and sediment samples for mercury analysis to prevent contamination of the samples.

10) Tetra Tech did not consider the results of their sampling at MCP-19, located at the confluence of Geyser Creek and the West Dolores River, when estimating the mercury loading from the drainage sub-basin (# 4), which contains the headwaters of the West Dolores River, Dunton, Cold Creek and the area of "significant mining activity". It is interesting to note that the measured concentrations of mercury in stream sediments at this site are actually less than those measured 2.9 miles upstream at site MCP-4 (Tetra Tech, 2001, Table 3-4, page 3-25). *(WTC&A)*

Response: Station MCP-19 is located in the upper part of sub-basin #4, and captures only a very small amount of the total drainage area of this basin. Therefore, MCP-19 is not appropriate for characterizing load leaving sub-basin #4. MCP-19 could have been considered for use in characterizing the load from upstream of Geyser Creek, which is primarily in sub-basin #10. However, station MCP-19 was sampled only once, in August 1999. Given the variability between samples we chose to rely on stations such as MCP-4 that were sampled twice, in June and August 1999.

11) … the current sampling of the West Dolores River is not only inadequate, but is also inaccurate as well, based upon their fictitious mines on Cold Creek and their failure to include the results from sampling at the confluence of Geyser Creek and the West Dolores River, when estimating the mercury loading attributable to the sub-basin containing Dunton and the nearby mines. *(WTC&A)*

This RESPONSE generally addresses the issues raised in section E:

The Division acknowledges the comments above and will incorporate them in the design of further studies for the development of Phase II mercury TMDL. We recognize that additional monitoring is needed to better assess the contributions from several sub-basins, in addition to air monitoring data. For this reason, this is a Phased TMDL, which allows additional monitoring to better characterize the mercury loading.

F) Comments related to the need to gather further data and further studies.

1) Data at this time are inadequate to support deriving targets, reductions and allocations. The TMDL should emphasize the lack of available data which supports the TMDL. *(SWCD)*

Response: We acknowledge the need for additional data, that is why this is a phased TMDL.

2) If Mancos shale has mercury in the 0.5 to 1.3 ug/g range, then is this background issue alone sufficient to be causing fish tissue concentrations exceeding 0.5 ug/g? If so, an "ambient-based standard" should be adopted to reflect the natural condition. The Mancos soils and outcrops should be mapped and included in the Use Attainability Analysis. *(SWCD)*

Response: The mercury levels found in the Mancos shale are not alone believed to be sufficient to be the primary cause of fish tissue concentrations exceeding 0.5 mg/g, although they undoubtedly contribute to the total watershed mercury load. In the TMDL report, sufficient data were available to characterize watershed loads by sub-basin. As a result, allocations are proposed for aggregate watershed load by sub-basin and not assigned to individual non-point sources within sub-basins. The primary mining-area sub-basins are distinguished by significantly higher loads than non-mining sub-basins, but these loads represent a combination of impacts from past mining and the background loading resulting from the presence of mercury-enriched geology associated with ore deposits. Mapping the Mancos soils and outcrops will be part of the effort to translate sub-basin scale allocations to more explicit allocations, to be addressed in Phase II.

3) Comment regarding the following: *Based on these values, loading to McPhee appears to be dominated by water column loads derived from watershed runoff. This likely reflects the significance of mercury loading in dissolved and suspended form from mine seeps. Atmospheric deposition to the Reservoir surface accounts for less than 10 percent of the total load to McPhee Reservoir. In contrast, atmospheric deposition accounts for close to 50 percent of the total load for Narraguinnep Reservoir. The reason that the two Reservoirs, within a few miles of each other, can have substantially different mercury contributions from atmospheric deposition is because the Narraguinnep Reservoir represents a larger percentage of the drainage basin than does the McPhee Reservoir surface area. Loads to Narraguinnep also include a significant contribution (estimated at 20%) via interbasin transfer from McPhee.)* -- provide data to support the statement contained in that paragraph and add the words "appears to" to those sentences concerning atmospheric depositions accounting for load percentages. *(SWCD)*

Response: The raw data are available in the document titled, "Review of Past and 1999 Mercury Data and Related Information for Six Colorado Reservoirs", (May, 2000) Tetra Tech Inc.

4) In the third paragraph of Section 5.6, the 2nd and 3rd sentences are unsubstantiated speculation and should be removed. There are no data to indicate whether the allocations are conservative, liberal or even approximate at all. *(SWCD)*

Response: Use of the 15" smallmouth bass to set the target is one liberal assumption, as this constitutes < 20% of the catch. It is unlikely that a subsistence fisherman would manage to dine solely on the bass. We have also included an explicit margin of safety, which is a conservative allocation.

5) The current data are just a start toward determining and achieving attainment. The TMDL should indicate that it is designed to "seek to" achieve appropriate levels of mercury in the affected fish. Because there are so few available data, there is no assurance that the steps proposed in the TMDL will reduce mercury levels in affected fish. *(SWCD)*

Response: That is why this is a phased TMDL.

6) Too few data to set loading restrictions. The data in this phase 1 TMDL for the Two Reservoirs are not sufficient to warrant setting loading reductions. Predictive uncertainty is so great, it is speculation and does not rise to the level of a completed TMDL, even for a Phase I effort. Speculation cannot be made reasonable by a legally mandated margin of safety. *(SWCD)*

Response: There are adequate data for a phased TMDL.

7) Practicing good science by recognizing the lack of data and moving forward to obtain that data should not be precluded by the need to meet consent decree due dates. *(SWCD)*

Response: Just as a correction, we are dealing with a settlement agreement and not a consent decree - two different legal instruments. With that said, there is a legal obligation to meet deadlines in a settlement agreement using the best science and information possible, even if there is best professional judgment involved. It appears the commentors would not do anything until more data are supplied. We disagree: we feel that the best science/best information does rise to an acceptable Phase I TMDL. Further, the Phase I TMDL will not result in controls. Rather, controls are more likely to follow Phase II. With that, we don't think any harm could be demonstrated as a result of Phase I.

8) Follow-up studies are necessary and expected. The TMDL should also emphasize throughout the need for extensive and expensive additional studies to understand the cause of the elevated levels of mercury in the affected fish and, further, that the studies are not required to be accomplished until funds are available from the EPA or the State of Colorado to perform them. We understand that EPA is diligently pursuing additional funding. *(SWCD)*

Response: Additional data collection has already begun.

9) Additional creel surveys are needed to better assess which fish and in what quantities are being caught and eaten. Fish creel studies should be adequate to support weighted averaging, seasonal analysis, and the derivation of site-specific consumer intake patterns. Thus, the creel study should be expanded to develop data to replace or confirm the default data used in the human health methodology for derivation of fish flesh thresholds. Such studies should be conducted early so that subsequent fish flesh sampling is consistent with the weighted averaging based on percentages of the fish actually consumed. *(SWCD)*

Response: The endpoint of a 15" smallmouth bass was representative of the creel studies. The weighted averaging based on percentages of fish consumed is only one of the possible approaches for adopting water quality criteria.

10) Stream monitoring is needed. *(SWCD)*

Response: Additional data collection has already begun.

11) The TMDL should report what the current limited data show. Further, we wonder how, when data are acknowledged as being poor, they suggest conclusions. *(SWCD)*

Response: The current state of the science was used in the collection and analysis of the data. We feel that the best science/best information does rise to an acceptable Phase I TMDL.

12) Lack of understanding of methylation. The water column concentrations in the Two Reservoirs are very low (i.e., 1 ng/l in Narraguinnep vs. the state water quality standard of 0.01 ug/l), yet high bioaccumulation occurs in some portions of the Two Reservoirs due to site specific soils, sediment, biology, or other factors not yet understood. The mercury cycling process is not understood despite the use of a Midwest model to predict the cycling results. The TMDL should be frank about the Division's lack of understanding in certain areas. The TMDL should contain more information about how little is known about methylation in the Two Reservoirs, especially since no elevated mercury in fish at nearby Totten Reservoir has been detected. The extreme range between low water column concentration and high, but infrequent, fish flesh concentrations needs to be assessed. *(SWCD)*

Response: This is why this is a phased TMDL.

13) Just because the two reservoirs are near each other and have the same climate are not adequate reasons to expect similar mercury dynamics. For example, Totten Reservoir is also near McPhee, has the same climate and water, but does not have a fish flesh mercury concentration problem. Indeed, their proximity and differences in mercury concentration bring into question the role of atmospheric deposition and potentially increase the role of local soils and geography or biological processes, unless there are still to be determined variations in air currents and directions. *(SWCD)*

Response: Totten Reservoir also has high fish tissue mercury and was part on the initial analysis of existing data in 1998. Data were collected by the USFWS in 1990, where 4 samples exceeded the State action level of 0.5 ppm.

14) The data collection and evaluation in Section 7, Table 7.1 should be more adequately detailed. Either provide specific data collection and monitoring needs or describe when that will be developed. *(SWCD)*

Response: This will be addressed in Phase II of this TMDL.

15) A major assumption in this Phase I TMDL is that the mercury sources can be controlled. The available data provide no answer to the source of the mercury. For instance, the mercury from the mining districts is greater than from non-mining districts, but there are no data to assess whether the mercury is from historic mining activities or from the background, mineral laden geologic formations. Phase 2 will attempt to collect data to confirm whether the sources can be controlled or whether analysis of the Phase I TMDL will need to be changed. *(SWCD)*

Response: Correct.

16) In Section 7.1, subparagraph 2, the date by which the studies are needed should be specified; in Section 7.1, subparagraph 3, the date by which the samples are to be taken and locations should be specified; in Section 7.1, subparagraph 4, specific details should be given concerning samples to be taken, i.e. how many, what type, etc.; in Section 7.2.1, where should new sample sites be located? *(SWCD)*

Response: This will be addressed in Phase II of this TMDL.

17) In Section 7.2.1, subsection entitled "Re-sampling of Existing Stations", how many resamples should be taken and how are they to be refined? The objectives and how they will be met should be stated clearly. *(SWCD)*

Response: This will be addressed in Phase II of this TMDL.

18) Table 7-1 does not include review of models and of the fish being eaten and, therefore, we suggest the following actions be added, including defining objectives, methodology, and criteria for each: Regular creel surveys at the reservoirs; Study of the mechanism of bioaccumulation; Review appropriateness of Watershed, sediment, D-MCM and other models used in Phase I; and Calibrate models determined to be appropriate using new data. *(SWCD)*

Response: This will be addressed in Phase II of this TMDL.

19) There are inconsistencies in the data: for example, there are low methyl mercury concentrations in the water column and sediment, while certain fish contain elevated levels. Discrepancies such as this must be addressed through further data collection and analysis. *(CMA)*

Response: Older fish and higher trophic level fish typically contain higher levels of elevated mercury. The concentration of methyl mercury in the water column and sediment is not inconsistent with the fish tissue levels found in the Reservoir in comparison to what has been observed in other areas of the country.

20) The Draft Phase I is not based on sound science and is thus arbitrary and capricious. Although the PNW supports the additional data collection, analysis and modeling that are planned for Phase II, many of the assumptions and conclusions in the Draft Phase I are not merely unsupported by the data presented in the report, but are actually contradicted by existing evidence. (…) Accordingly, PNW believes that CDPHE's completion of Phase II alone will not resolve the issues. Instead, CDPHE should evaluate all of the evidence before it, including the critiques of the science used to support the Draft Phase I, the contradictory information discussed herein, and the comments previously submitted concerning the TSD, and develop a TMDL based upon the totality of the evidence. In sum, while CDPHE repeatedly acknowledges serious data gaps and analytical uncertainties, the Draft Phase I nevertheless forges ahead and prescribes load allocations for identified sources, including Four Corners, with the hope that the allocations will ultimately be supported by anticipated future data. This is untenable, and the Draft Phase I is inadequate as a matter of law. *(PNW)*

Response: Phase I is based upon all existing and readily available data. To the extent data gaps were identified, additional data were collected based upon the amount of available time and resources. The Division and EPA carefully chose the project contractor so as to ensure that existing data were properly utilized and data gaps accurately identified. Any remaining uncertainty (i.e. post phase II) will be reflected in the regulatorily mandated margin of safety. Any final loading allocations will be made only after a reassessment of the available data, the analytical methods or models and any additional evidence of record. It is hoped that all interested parties remain actively involved as the Division proceeds forward.

21) … the technical support document studied only the southeastern third of the Upper Dolores Watershed, rather than the entire watershed. The document failed to provide any justification for this sub-division, and it would seem likely that additional current and historic sources of mercury are located within the areas that were excluded from the study. *(PNW)*

Response: The Phase II monitoring will look at additional sub-basin sites that were not sampled in 1999. This includes the Dunton and La Plata mining areas, which have been identified as potential loading sources.

22) … the technical support document failed to evaluate Narraguinnep Reservoir's historic watershed even though the Narraguinnep Reservoir predates the existence of McPhee Reservoir by over 80 years. *(PNW)*

Response: This will be addressed in Phase II of this TMDL.

23) …the sampling of sediment and unfiltered water from the Narraguinnep Reservoir in 1999 was obtained from the margins of the reservoir, and not from the open water. … underestimating the contribution of mercury from long time deposition of transported sediment. *(PNW)*

Response: Samples were collected from the porewater near the wetlands in addition to the open water.

24) Two months of limited sampling in one summer cannot adequately consider the distribution of mercury in sediment that has accumulated over decades and has been migrating through all parts of the watershed for the same time period. *(PNW)*

Response: *Current preliminary research has found that the most reactive mercury, which is most readily methylated is also the newest deposits.*

25) There is no discussion of the accuracy and precision of the data. The Draft Phase I fails to explain, or even suggest whether or why this data provides an appropriate representation of typical watershed conditions. … This data may be sufficient for the purpose of scooping potential load sources. It cannot support the numerical load allocation conclusions contained in the Draft Phase I. *(PNW)*

Response: The data are adequate for a Phase I TMDL.

26) … the very few water column samples - 18 for McPhee and 17 for Narraguinnep, collected during only two sampling events during the summer of 1999 – are completely inadequate. These data, although they may be useful if coupled with additional data, show considerable variability in total dissolved mercury and are insufficient for supporting any conclusion about typical mercury concentrations in the reservoirs. *(UWAG)*
Response: The data are adequate for a Phase I TMDL.

This RESPONSE generally addresses the issues raised in section F:

The Division acknowledges the comments above and is currently incorporating them in the design of Phase II mercury TMDL investigation, sampling and studies. Some limited investigation and sampling design and collection has already started to address Phase II.

G) Comments related to mining districts.

1) Natural mineral belt sources. The TMDL must distinguish between natural background mercury in areas where mining has taken place and mercury added to the system from disturbance of the soil and rock from actual mining or where Hg has been added to the system via metal benefaction. *(SWCD)*

Response: The mercury levels found in the Mancos shale are not alone believed to be sufficient to be the primary cause of fish tissue concentrations exceeding 0.5 mg/g, although they undoubtedly contribute to the total watershed mercury load. In the TMDL report, sufficient data were available to characterize watershed loads by sub-basin. As a result, allocations are proposed for aggregate watershed load by sub-basin and not assigned to individual non-point sources within sub-basins. The primary mining-area sub-basins are distinguished by significantly higher loads than non-mining sub-basins, but these loads represent a combination of impacts from past mining and the background loading resulting from the presence of mercury-enriched geology associated with ore deposits. Mapping the Mancos soils and outcrops would be a useful exercise as the effort to translate sub-basin scale allocations to more explicit allocations proceeds in Phase II.

2) Comment regarding the following: *[Sub-basins 1 and 2 intersect the Rico mining district. A large number of abandoned mines and several mine sweeps are present in this area (see Tetra Tech, 2000). The Rico-Argentine mine on Silver Creek was one of the largest mines in this drainage and it has previously been suggested as a source of mercury contamination (Tetra Tech, 2000).]* -- this paragraph has unquantified numbers and innuendo regarding mines not substantiated by data. We would suggest that the paragraph be removed or be substantiated. *(SWCD)*

Response: This information was presented in the November 11, 1994 "Site Inspection Analytical Results Report on McPhee and Narraguinnep Reservoirs, Dolores, Colorado", prepared for USEPA by the Morrison Knudsen Corporation and "the Preliminary Assessment of McPhee Reservoir, Montezuma County, Colorado", prepared by Ecology and Environment, inc, September 12, 1991.

3) Comment regarding the following: *[A discussion of the history of the mining districts and the potential for mercury contamination is presented in Tetra Tech (2000 and 2001). In general, the quantity of mercury loading from mining operations has not been measured directly. Instead, the loads must be estimated through a combination of observed data in the water column and sediment (Section 3.5), coupled with the watershed linkage analysis (Section 4.4).]* -- This method does not adequately address the specific sources of mercury within the mining districts where the background geologic formations are potentially the major contributor of mercury. The background mercury in the mining districts is expected to be much greater than in non-mining areas. Metal sulfide mining occurred in geothermically altered areas where native mercury (Hg) and Cinnabar (mercury sulfide) are concentrated. *(SWCD)*

Response: Additional data will be collected for the Phase II TMDL.

4) The TMDL proposes a 50% reduction in mercury from mining sources, but no means to achieve such reductions are identified. *(SWCD)*

Response: The Phase I TMDL will not result in controls. Rather, controls are more likely to follow Phase II.

5) Mining sources (historic in nature) have been identified as an important non-point source contributor of mercury; however, there has been no direct measurement. Further investigation based upon direct observation is necessary before final reductions can be quantified. *(CMA)*

Response: Phase II of this TMDL is being conducted taking in consideration potential contributions from the whole watershed and also from historic activities.

6) As to mercury contributions suspected from historic mining activities, a number of factors including land ownership, accessibility to previously mined areas, and annual snowpack in the region may make reduction strategies difficult to implement. *(CMA)*

Response: Phase II of this TMDL is being conducted taking in consideration potential contributions from the whole watershed and also from historic activities.

7) Comment regarding the following: *"Past mining activities are an important source of mercury load in the McPhee/Narraguinnep watershed."* …this statement is somewhat contrived as some mining areas of the watershed have neither mercury in the rocks nor evidence of mercury use by mining. Also, the text lists many types of mines or minerals that occur in the Dolores watershed, including Ag, Au, Pb, Zn, Cu, coal, U, V, Mg, Fe, S and sand and gravel. The list, presented amidst the mercury discussion, makes it appear that the writers believe these mines are potential mercury sources. However, evidence for mercury in the coal, uranium, vanadium, magnesium, iron, sulfur and sand and gravel operations is never presented, and evidence for mercury in the other types of mines is sketchy for some districts and conjectural in the others. *(DMG)*

Response: The source section of the TMDL must document all potential loading sources. The allocation section in Phase II will address the needed reductions based on the estimated loads for the sources where reductions will be applied. These allocations will be based on the additional monitoring data collected which will more accurately characterize the actual sources that will need to be controlled.

8) The text speculates that ores in each mineral district of the region either did contain or probably contained mercury. For mineral and ore deposits draining to the Dolores River, this is not correct. The text also speculates that mercury was added to streams via fallout from Hg amalgamation. This is not everywhere correct because amalgamation was not used applies (sic) in some of the districts. Most of the ores were milled and smelted, not amalgamated. Some of this occurred within the region while some occurred outside. *(DMD)*

Response: Historic mining procedures and potential mercury contribution will be further investigated and documented in Phase II of this TMDL.

9) Specie Ridge (the owner of Emma Mine), the Environmental Protection Agency (EPA) or its contractors, the Division of Minerals & Geology and a previous owner of the Emma Mine have, since 1982, sampled a discharge emanating from fractures located approximately 30 feet below the lower-most entry into the Emma mine. Mercury, as measured by then and current EPA-approved methods, has only been detected two or three times; twice in the previously described discharge stream and once in the river, approximately 650 feet downstream from the mine and near the site of the historic mill tailings pond. In only one of these instances was the mercury concentration above the lower limit of detection on the analytical method employed. *(WTC&A)*

Response: The historical data collected prior to the 1999 sampling did not utilize the lower detection levels of 0.2 ng/l, which is the currently approved EPA method 1631.

10) We sampled the main Emma mine dump in 1995, later sampled old mine dumps, stockpiles and the historic mill tailings as part of a Phase II Environmental Assessment in 1999 and, most recently, in August 2001. While mercury was detected in dump materials, the highest concentration detected was 4.54 milligrams/kilogram (ppm) total mercury from whole rock samples. However, the corresponding Toxicity Characteristic Leaching Procedure (TCLP) concentration from this same sample was only 0.0069 milligrams/liter (ppm), far lower than the EPA's current Maximum Contaminant Level of 0.2 milligrams/liter. In addition, the total surface area of these dumps (2 in number) is merely 1.036 acres. *(WTC&A)*

Response: The comparison to the MCL is not appropriate for determining the potential sources contributing to the fish tissue levels exceeding the State action level.

11) Amalgamation was quite likely not employed in the treatment of the Emma ore. The mercury concentrations found in samples of the historic mill tailings were all less than 1 milligram/kilogram. Descriptions of the mill facilities, as contained in various old reports, fail to mention an amalgamation circuit nor do they describe any amalgamation equipment. Indeed, one author (H. H. Fields, 1919, page 21) stated that ore did not contain any free gold. Therefore, Emma ore would not have been amenable to amalgamation recovery. By all accounts, much of the Emma's ore was shipped in crude form to smelters at Durango and Denver. Some ore was concentrated by gravity, and later by floatation, and the concentrated were shipped to the same smelters. *(WTC&A)*

Response: Historic mining procedures and any potential mercury contribution will be further investigated and documented in Phase II of this TMDL.

12) The Tetra Tech study is flawed in that it attributes mercury loadings in the West Dolores River to mines in the Cold Creek area, located approximately one mile upstream from Dunton. This is based upon two samplings at their site MCP-4, located at the confluence of Cold Creek and the West Dolores River (Tetra Tech, 2001, figure 3-8, page 3-24). These samples did contain elevated mercury concentrations in the context of the "super sensitive" analytical methods employed by Tetra Tech, but were still far below the LLD of currently approved EPA analytical methods (op cit, Table 3-4, page 3-25). Tetra Tech considers the total mercury content of the water itself. Their discussion of potential sources mentions "the significant mining activity on Cold Creek, near Dunton". The Cold Creek area is pristine, showing no evidence of previous exploration or mining. The "significant mining activity" is actually located **a mile downstream** from their sample site MCP-4. A possible explanation for Tetra Tech's blunder is given in the details of the WT Cohan & Associates' document. *(WTC&A)*

Response: EPA has approved method 1631. This analytical method's detection level is 0.2 ng/l.

13) With respect to the "significant mining activity" in the Dunton area, the total recorded production from the district, during the period 1902-1941, is less than 200,000 tons of crude ore. This came from essentially two mines, the Smuggler-Almont and the Emma. While there are numerous patented mining claims shown in the district, most of them have had little or no production. There has been no production since 1941; the work conducted in the Emma in the 1980's consisted solely of underground exploration. *(WTC&A)*

This RESPONSE generally addresses the issues raised in section G:

The Division acknowledges the comments above and will incorporate them in the design of further studies for the development of Phase II mercury TMDL. At that time, the Division will appreciate any input from the Division of Minerals and Geology, such as maps of old mines, types of mining activities, discharge data, etc.

H) Comments related to modeling.

1) The results of the modeling are at best "ballpark" estimates, using the numerous assumptions described above, of what might happen to fish tissue mercury levels if mercury loading in the Reservoir water were decreased. No data are available to demonstrate that the results predicted in the TMDL will actually occur because the bioaccumulation mechanism is not known. We also wonder whether there is any assimilative capacity remaining in the Two Reservoirs or either of them. What happens to the mercury? Does it eventually become tied up in the sediments? *(SWCD)*

2) Lack of modeling standards. Colorado has no criteria for evaluating and accepting models and their projections. Therefore, the Division has no benchmark for determining whether a prediction is speculative or good science. The modeling validation in the TMDL is not clear. Three models were used. Because the first is highly biased in predicting water column concentrations, how does this affect the final models results? Each model used should be evaluated quantitatively for the accuracy of its prediction. The cumulative accuracy of the three models should be provided, or at least discussed. While the discussion demonstrates the uncertainties of the models, there should be criteria to determine when uncertainty is still too great to support any predictions with regulatory effects. *(SWCD)*

3) Colorado has no criteria for when a TMDL data base, modeling projections and final computations of loading reductions and allocations are sufficiently certain. No quantitative estimate of the cumulative uncertainty of the sequential modeling is given. Cumulative uncertainties and, therefore, a large margin of safety, do not provide a basis for concluding that the loading and allocation limits in fact bear a reasonable relationship to protecting uses. *(SWCD)*

4) … that "good agreement between model predictions and observed mercury levels in sediments and surface waters [sic] were achieved. . ." No detail is provided to define what is "good agreement." If model predictions are off by a factor of 2, this is not a "good agreement." As far as we know, the State has no criteria for the measurement of acceptable accuracy of predictive models. If there are such criteria, the Division should state them. *(SWCD)*

5) If the D-MCM model calibration is based on a comparison of observed and predicted results in the water column and sediment, how is confidence in its predictions of fish flesh concentrations assured? Is it this model that determines the necessary mercury concentration reduction in fish flesh and predicts the water column concentration reduction necessary relative to that reduction in fish flesh concentration? That relationship calibration and validation is not clear. Is there any evidence of the calibration and validation of the predicted and observed fish flesh concentrations and related water column concentrations? What State criteria are there to measure and assure confidence in such predictions? Total mercury and methylmercury concentrations in the surface waters and sediments of McPhee Reservoir are stated to be within the "typical range for freshwater systems." Yet, most typical freshwater systems do not have fish advisories for mercury. If the concentrations are within the typical range, then the calibration and validation of the model is especially critical in this unusual situation, where the water column is within typical ranges but the fish flesh mercury concentration is too high. Evidence that the model is accurate in predicting fish flesh concentrations from water column concentrations is not clear. *(SWCD)*

6) The model does not provide confidence in the predictions because there were only two temporal sampling dates. Since there is demonstrated natural variability in the water column of mercury concentrations, is there also variability in fish flesh? Seasonally in the fish flesh? If there is variability in fish flesh, is the highest methylmercury concentration in the summer, when the lowest elements of the food chain are the most active in converting mercury to methylmercury? It is necessary to look, seasonally and yearly, at fish flesh samples, as well as water and sediment data. Predictions are not "accurate and reliable" based upon only two summer time sampling events in an annual cycle, that is supposed to be related to life-time chronic exposure. Two summer data samplings are not representative of the water body. This is inconsistent with EPA and State Data Quality Objectives guidance for adequate data and good science. Although page 6-5 of the TMDL Report states that annual mercury loading is more important for the attainment of standards than instantaneous or daily concentrations, no annual data are available. *(SWCD)*

7) With regard to Section 4.1.1, fourth paragraph, the predictive capacity of the model has not been calibrated. There is no evidence in the draft TMDL of this basis for the final conclusion of the modeling effort. *(SWCD)*

8) Because of the admitted uncertainty with the modeling assessment due to lack of data, a margin of safety, estimated at 25%, was used to account for the uncertainties associated with the modeling, source assessments and lack of data. It is unclear on what basis the unallocated reserve was set at 30% of loading capacity of waterbody. *(SWCD)*

9) The GWLF model assumes that sediment that is accumulated for delivery over the period of one year is all transported, by precipitation and surface runoff, in that same year. However, the model does not account for sediment that may be accumulated in one year, but transported and deposited in another year. … it is likely that the model produced an underestimation of the sediment contributions to mercury in the watershed. *(PNW)*

10) … the Draft Phase I assumes that sediment movement in the watershed occurs primarily in association with a few high flow scour events, rather than at a steady-state constant rate. … could result in an underestimation of the contribution of mercury loading from watershed sediments. *(PNW)*

11) … the consultant elected to modify model constants, not variables, to "better reflect annual runoff totals for the McPhee watershed." The model was never formally calibrated. … The greatest limitations of the model were observed in errors accumulated from high flow years. These high flow years are those that are proven to cause the high scour event when most sediment will be transported. Not considering the effects of these events again underestimated the effects of sediment transport on reservoir mercury cycling. *(PNW)*

12) EPRI's Dynamic Cycling Model (D-MCM) identifies a correlation between sedimentary mercury concentrations and fish tissue mercury concentrations. The Draft Phase I attempts to further correlate water column mercury concentrations with sediment mercury concentrations, and therefore fish tissue mercury concentrations. This correlation has not been proven and may lead to poor allocation determinations. *(PNW)*

13) … the TMDL's use of the D-MCM model for TMDL loading studies is premature and could be beyond the applicable scope of the current D-MCM model. *(PNW)*

14) The EPRI D-MCM model was manipulated in inappropriate ways and is not proven in this application. In the model application for the McPhee reservoir, other sources of mercury were adjusted in the same proportion as atmospheric deposition adjustments without any justifications for such adjustments. The model also was not designed to model effects of large fluctuations in water level on mercury cycling, so it assumed a constant water level even though the mean water level fluctuation is on the order of 10 meters. … In order to make the model results fit with the limited available data, constants were changed within the model until there was good agreement with the limited data. This method of calibration is highly questionable and renders the model results very suspect. If model results do not match site-specific measured data, then the answer is not to tamper with constants within the model, but to question both the applicability of the model and the adequacy of the data. *(UWAG)*

This RESPONSE generally addresses the issues raised in section H:

Mercury is currently the leading cause of impairment in the Nation's estuaries and lakes and was cited in nearly 80 percent of fish consumption advisories (2,242 of 2,838) reported by states in 2000. The geographic extent of mercury advisories covers more the 10 million acres of lakes and more than 400,000 stream miles – increases of about 7 and 48 percent, respectively, over advisories reported in 1998 (Mercury in Stream Ecosystems – New Studies Initiated by the U.S. Geological Survey, by Mark E. Brigham, David P. Krabbenhoft and Pixie A. Hamilton – USGS Fact Sheet 016-03, 2003).

The Modeling for the mercury TMDL for the reservoirs was conducted by Tetra Tech, one of the most reputable environmental consulting firms in the US and specialists in modeling. During the Phase II of the mercury TMDL, the data gaps and further study needs identified in the Phase I TMDL will be addressed.

Modeling was used to conduct the technical analysis of the cause and effect relationship between the watershed loading of mercury, mercury cycling in nature and bioaccumulation processes in the lake. The analysis provides the basis for estimating total assimilative capacity of the water body and any needed load reductions of mercury, in order to meet the target fish tissue concentration. The analysis took in consideration several key issues: fish tissue concentrations of mercury depend not only on external loads, but also on in-lake processes (methylmercury availability on surface water and in shallow sediment areas where fish feed), the fact that

mercury biomagnifies at each trophic level and bioaccumulates through the food chain, methylation process depends on several factors such as the concentration of available reactive mercury (Hg II), the microbial concentration, pH, temperature, redox potential and the presence of other chemical processes.

Many things can happen to Mercury once it enters a body of water – it can vaporize back to the atmosphere, it can adsorb to sediment particles, remain suspended and slowly deposit in the bottom. Once it the bottom, it can be methylized (especially at the edges of the water and in wetlands) and become part of the food web. Some portion of mercury can become part of the deeply buried sediment and become unavailable to the biota. These processes of mercury cycling in nature are recognized as important and integrated in the models utilized by Tetra Tech, Inc.

For this Phase I, Tetra Tech utilized a combination of models that represent the watershed loading of mercury, of mercury cycling and of bioaccumulation in the lake. Ionic mercury is particle-reactive and because of this characteristic, much of the mercury becomes adsorbed to sediments and moves through the watershed during major scour events. Because of this and given the limited available data, the watershed "external" loading is estimated using non-snowmelt loading of dissolved and suspended particulate mercury, snowmelt loading of dissolved and suspended particulate mercury (although this does not appear to be a significant source of mercury loading to the reservoirs), and watershed sediment-associated mercury load.

Data are not available at this time to specify parameters or calibrate a detailed representation of flow and sediment delivery within the watersheds. Therefore, a relatively simple, scoping-level analysis of watershed mercury load, based on annual mass balance of water and sediment loading from the watershed is used for this TMDL. The model selected was the Generalized Watershed Loading Function (GWLF) model (Haith et al. 1992). This model provides a mechanistic, simplified simulation of precipitation-driven runoff and sediment delivery, yet it is intended to be applicable as a scoping tool without formal calibration. Estimates of watershed mercury loading are based on the flow and sediment loading estimates generated by GWLF through application of observed mercury concentrations. Cycling and bioaccumulation of mercury within McPhee were simulated using the Dynamic Mercury Cycling Model (D-MCM, Tetra Tech 1999c). D-MCM is a Windows 95/NT-based simulation model that predicts the cycling and fate of the major forms of mercury in lakes. It is a time-dependent mechanistic model, designed to consider the most important physical, chemical and biological factors affecting fish mercury concentrations in lakes. This model and its previous versions have been applied extensively to many lakes in the nation: several lakes in Wisconsin, Florida and Ontario, Canada, to cite a few. The present version of the model has updated mercury kinetics and an enhanced bioenergetics treatment of the food web. Some inherent limitations of the model at this time are knowledge of: the true rates and governing factors for reduction of methylation and reactive mercury; factors governing uptake of methylmercury at the base of the food web; and the effects of anoxia and sulfur cycling. The model also contains some weaknesses related to how it addresses rapid and slow exchanges of reactive mercury and sediment particles. The error associated with this process can be larger in systems with low sedimentation rates (for example oligotrophic lakes) than in systems that have a large sedimentation rate, such as many reservoirs.

More data will be gathered in Phase II of this TMDL and the problems associated with assumption and limitations, currently built into the model, will be addressed.

Calibration-related issues:

The D-MCM model was calibrated to reproduce observed mercury concentrations in sediments, water and fish. An existing calibration for Little Rock Reference Lake in Wisconsin was used as a starting point that included previously calibrated values for all parameters relevant to mercury cycling (partitioning and reaction rate constants, etc.) Inputs associated with site conditions (bathymetry, flow rates, temperature, water chemistry, particulates, etc.) and external mercury loading inputs were then modified to reflect conditions at McPhee Reservoir, where data were available or could be estimated. The model was then run and results compared to field data. In general, the calibration procedure is an iterative process but essentially follows, in sequence, the six steps below:

1) Calibration of model to match observed bulk sedimentation rates.

2) Calibration of growth rate and weight vs. length relationships for relevant fish species. Adjustment of population sizes to match lake or reservoir productivity.

3) Adjusting, if necessary, selected model constants so that the partitioning of reactive mercury and methylmercury concentrations between dissolved and particulate phases agrees with observations on both sediments and the water column.

4) Adjusting model parameters until methylmercury concentrations in water (unfiltered) and sediments (on solids) agree with observations. Again, calibration might involve adjusting partitioning of MeHg onto solids and in rare cases modifying rate constants for reactions such as methylation and de-methylation.

5) Adjusting model parameters, if necessary, so that methylmercury concentrations in the lower food web agree with observations. Partitioning of MeHg into benthos and zooplankton can be adjusted.

6) Examining fish mercury levels. Diet and, in rare instances, species-specific bio-energetic parameters can be modified to improve agreement between the model and observed fish mercury levels.

The model calibration was undertaken by the developers of the D-MCM model and the quality of the agreement was judged to be "good" based on their experience with many similar studies. A significant amount of variability in observed values about the model-predicted central tendency is expected for these environmental concentrations due to spatial heterogeneity, short-term temporal variability, and analytical uncertainty. For a more detailed discussion on how the model behaved and on the results can be obtained in the "Technical Support for Developing a Total Maximum Daily Load for Mercury in McPhee and Narraguinnep Reservoirs, Colorado" document, prepared by Tetra Tech, Inc. and submitted to U.S. EPA and the State of Colorado in August 2001 (revised draft).

The State has not established quantitative criteria for the acceptable accuracy of predictive models. However, the important model output for regulatory purposes is the predicted fish tissue concentration, not intermediate environmental concentrations.

Load Allocation:

A waterbody's loading capacity represents the maximum rate of loading of a pollutant that can be assimilated without violating water quality standards (40 CFR 130.2(f)). Application of the D-MCM lake mercury model provides best estimates of the loading capacity for mercury of McPhee Reservoir of 2, 592 grams of total mercury per year. This is the maximum rate of loading consistent with meeting the numeric target of 0.5 mg/kg of mercury in fish tissue. The loading capacity estimate for Narraguinnep Reservoir is 39.1 grams of total mercury per year.

This estimate of loading capacity is subject to considerable uncertainty, as described in the preceding sections. Uncertainty in the estimation of the loading capacity, and thus the TMDL, is addressed through the assignment of a margin of safety.

The loading capacity is not necessarily a fixed number. The numeric target for the TMDL is expressed as a mercury concentration in fish tissue. This numeric target is linked to external mercury load through a complex series of processes, including methylation/de-methylation of mercury and burial of mercury in lake sediments. Any alterations in rates of methylation or in rates of mercury loss to deep sediments will change the relationship between external mercury load and fish tissue concentration and would thus result in a change in the loading capacity for external mercury loads.

This response is taken from the "Technical Support for Developing a Total Maximum Daily Load for Mercury in McPhee and Narraguinnep Reservoirs, Colorado" document, prepared by Tetra Tech, Inc. and submitted to U.S. EPA and the State of Colorado in August 2001 (revised draft). For a more complete discussion on modeling and other issues, consult this document and the "Review of Past and 1999 Mercury Data and Related Information for Six Colorado Reservoirs" Tetra Tech, Inc., May 2000.

I) Technical questions.

1) At Section 4.4, the last paragraph before Table 4.1, the grams of mercury estimated in each acre-foot of McPhee water needs to be included so the calculation of 15.9 g can be verified. Using these numbers, the amount would be 0.002 per acre-foot. *(SWCD)*

Response: The comment refers to the table summarizing loading to Narraguinnep Reservoir. Interbasin transfer from McPhee to Narraguinnep is estimated as 7,952 acre-feet per year. The median total mercury concentration in McPhee Reservoir is estimated at 1.65 ng/L (calculated as the mid-point of the medians from the June and August sampling). As stated, these numbers should yield an estimated total mercury load from McPhee to Narraguinnep of 16.2, rather than 15.9 g/yr as stated in the text. The concentration of 1.65 ng/L is equivalent to 0.00204 g/AF.

2) At Section 4.4, the last paragraph above Table 4.4, the calculation of load per volume and surface area is not clear. Does volume represent the reservoir capacity or average annual runoff? Dividing 3,049 by either of those numbers does not result in 4.66. The same problem occurs for the surface area. *(SWCD)*

Response: Volumetric and areal mercury loading rates to McPhee Reservoir are incorrectly calculated in the table. Based on a typical storage of 318,000 AF and typical surface area of 3890 acres, the volumetric loading rate to McPhee is 9.7 mg/AF/yr and the areal loading is

0.193 mg/m^2/yr. Volumetric and areal loading rates for Narraguinnep are calculated at typical volumes of 17,000 AF and surface area of 550 acres. This correction means that both the areal and volumetric loading rates are higher for McPhee. However, the correction does not alter any of the later analyses. The lake modeling is based directly on modeled annual loads and observed concentrations, not the volumetric/areal rates shown in this table

3) In Section 4.2, under the paragraph #3 entitled "Watershed sediment . . ." please provide a substantiation of the first sentence. *(SWCD)*

Response: Inorganic mercury deposits on all surfaces, adsorbs to sediment particles and moves through the watershed in response to several mechanisms, including storm events. Some preliminary results from a nearby, similar watershed show significant mercury loading to surface waters in response to storm events. This will be further investigated in Phase II of this TMDL.

4) The first paragraph in Section 4.4 needs more detail and should show calculations for instream loadings and sediment load. *(SWCD)*

Response: This will be addressed in more detail in Phase II of this TMDL, once more data are gathered.

5) In Section 4.4, 7th paragraph, the term "elevated" should be quantified. *(SWCD)*

6) In Section 4.10, third paragraph, what does "quite plausible" mean? What is the basis for this statement? *(SWCD)*

7) With regard to Section 4.1.1, second paragraph, mercury cycling in the environment is generally not linear and, therefore, we believe this assumption is not reasonable. *(SWCD)*

8) Section 5.3 is not clear. What is the relationship between 25%+-? What is the target loading capacity – 2592 or 1814? The unallocated reserve is not clear, what does it do? How is it applied? What is the legal authority for an unallocated reserve? Who gets the benefit of it? Who allocates it? Is the McPhee reduction 15%, as stated in Section 4.9.2, or 40.5% as implied here? *(SWCD)*

9) In the 10th paragraph of Section 6.1, the second sentence is not substantiated in that the identified loads may not be the cause and, therefore, should be removed. *(SWCD)*

10) In Section 6.1, 11th paragraph, the last sentence should either be removed or should describe the basis for the statement of "high probability" and what that means. *(SWCD)*

11) Regarding the second sentence in the 12th paragraph of Section 6.1, why is it "reasonable to assume" and why linear. Please explain the basis for this statement with backup data. *(SWCD)*

12) In the second sentence of the 13th paragraph of Section 6.1, please justify "best estimate," since others may also make estimates, why is this the best? Additionally, are adaptive management and monitoring programs described in Section 7? *(SWCD)*

13) In Section 6.3, the last sentence of the first paragraph doesn't make sense. It should either be expanded or deleted. Concerning seasonal variations, since these are mountain area reservoirs

and infrequently used in the winter, seasonal variation in loading and fish flesh concentrations are relevant to the public being protected. If mercury fish tissue concentrations diminish during the winter and increase in the summer, then the fish tissue standards and water quality standards may need to be changed to reflect the lower number of meals consumed, the lower risks and the higher allowable concentrations in the fish flesh allowable. *(SWCD)*

14) At Section 4.9.2, the narrative states that a 15% reduction in mercury loading will achieve the 0.5 ug/g fish flesh target concentration. This statement needs to be tempered. What kind of reduction would be necessary if the fish flesh target were 0.6 ug/g? *(SWCD)*

15) On the paragraph "…given the small amount of flow, most of which does not discharge via direct surface pathways, point sources are not expected to provide a significant amount of mercury loading to the reservoirs." Comment: Actually, the amount depends on both flow and concentration. Flow alone is no predictor of contaminant load. *(DMG)*

16) …would like to bring to the Division's attention a potential mercury source that apparently has been overlooked and on which no investigation has been undertaken - that is mercury entrainment in the flood plain. *(CFAR)*

17) Preliminary allocation is arbitrary and not supported by the record. There is an admitted gap between the available data and state of knowledge of mercury deposition and the conclusions and recommendations of the report. … In addition to being arbitrary, the stated preliminary allocation assessment of a 75% reduction in atmospheric loading is too nebulous to be of any direct value. *(PSC of NM)*

This RESPONSE generally addresses the issues raised in section I:

The above comments will be evaluated, addressed and properly incorporated in the Phase II of this TMDL. The State feels that any further technical questions need to be addressed at a later time, after move investigative work is done.

J) The Division also received a few general comments.

1) The early sections of the TMDL should reference the tasks in Section 7 when new studies are mentioned as being required. *(SWCD)*

2) It would be helpful for tracking future tasks to include in Chapter 7 a matrix of the uncertainties and how they are to be addressed in the future studies. *(SWCD)*

3) No point sources of Mercury. The TMDL should state clearly that there is no significant point source contribution to the mercury in fish in the Two Reservoirs. *(SWCD)*

4) In a number of places uncommon words are used instead of commonly understood words. *(SWCD)*

5) Figure 4.2 in Section 4.9 needs to be included. *(SWCD)*

6) Atmospheric deposition is to be reduced by 75% through power plant MACT. A 40% reduction in McPhee loading is necessary to reduce its trans-basin loading to Narraguinnep, but a

66% reduction in background loading to Narraguinnep is further necessary. This is unrealistic. No possible mercury standard should reflect an unattainable condition. *(SWCD)*

7) Other steps to seek to reduce mercury in some fish in the Two Reservoirs need to be outlined, including such steps as fish management and chemical and physical intervention. *(SWCD)*

8) The Colorado Mining Association supports a phased approach, which will provide an opportunity to fill in the data gaps, conduct additional analyses, and refine the allocations that will lead to reduction strategies. *(CMA)*

9) The CDPHE has selected a wet weight of 0.5 μg/g as the advisory action level because it is in the mid-range of levels selected in other states. The Department should retain the flexibility to revise this advisory action level in the event that demonstrated evidence become available. This flexibility is particularly important since the reservoirs meet applicable water quality standards of 0.01 μg/l, but rather were listed due to the fish advisory for mercury. *(CMA)*

10) Reduction measures were not identified in this phase, and will be difficult to devise in Phase II due to the fact that much of the atmospheric deposition implicated thus far is from outside Colorado, and non-point land sources are from historic, rather than current activities. There are a number of control regulations under discussion at the federal level to reduce mercury from coal-fired power plants; it may be premature for the Division to pursue reduction strategies independently of those actions. *(CMA)*

11) The Draft Phase I arbitrarily discounts mercury discharges from point sources. *(PNW)*

12) The Draft Phase I and the technical support document have not contemplated the significant impacts of forest fires on mercury mobilization and deposition. *(PNW)*

13) There are pervasive uncertainties throughout the TMDL Phase I Public Comment Draft *(my comment - several examples follow).* … In fact, much of the Public Comment Draft report and the earlier Tetra Tech technical support document are simply statements of what is not known, what has not been done and recommendations of what should be done to be able to reliably characterize atmospheric deposition of mercury at the Reservoirs. *(PSC of NM)*

14) The TMDLs do not meet the requirements of Section 3030(d) of the Clean Water Act, … because the wasteload allocations (WLAs) are not set at levels necessary to achieve standards, or even to reduce the impairments as much as possible. For the TMDLs addressing non-point sources, there are no "reasonable assurances" the load allocations (LAs) will be achieved. *(EJ)*

15) … the TMDLs have little or no implementation plans, schedules for implementation, or identification of implementation measures. *(EJ)*

16) There is no wasteload allocation included in this TMDL, despite the fact that there are two point source discharges of Mercury Total Maximum Daily Load for Mercury in McPhee and Narraguinnep Reservoirs, Colorado Phase I, March 29, 2002, page 5-7. This TMDL is not compliant with the CWA. *(EJ)*

17) The recommended reductions in the TMDL are not supported by the conclusions of the technical support document. Colorado recognizes this uncertainty (..how atmospheric mercury contributions may present themselves in the environment) in the TMDL, but continues to stress

the atmospheric deposition component. … taking any action to address air deposition of mercury is not defensible. *(UWAG)*

This RESPONSE generally addresses the issues raised in section J:

The above comments will be evaluated, addressed and properly incorporated in the Phase II of this TMDL. The State feels that any further technical questions need to be addressed at a later time, after move investigative work is done.

K) Comments related to the calculation of the Margin of Safety.

1) The margin of safety discussion walks a tight rope; 25% is used, but the model's predictive correlation is more like 60%. The unallocated reserve is 30%. This is just too speculative to generate any loading reductions until further analysis is complete. A broad margin of safety does not excuse speculation, even best efforts speculation, by a governmental agency. The margin of safety discussion should also include all of the intrinsic safety margins in the process. *(SWCD)*

2) The inconclusive nature of this TMDL is confirmed by the statement that the "loading capacity estimates for McPhee and Narraguinnep Reservoirs are subject to considerable uncertainty, as described in the preceding sections." This uncertainty is addressed through the assignment of a Margin of Safety. Commenters do not believe that a Margin of Safety is a substitute for speculation. There must be sufficient data to make a rational connection to a reasonable conclusion and gaps in such data may not be excused with a margin of safety when the gaps are too big to support basic inferences. In light of the extremely low water quality concentrations, a huge data gap precludes concluding that lower loadings are needed because it is not certain that external contemporaneous loading is the source of the methylation seen in fish body tissue. *(SWCD)*

3) … while the regulatory approach to uncertainty is to create a margin of safety, this assumes a minimum rationale supporting the conclusion the restrictions are indeed necessary and related to protection of the public health. Speculation of necessary actions to protect public health does not justify a margin of safety. No regulatory effect of the TMDL should be required, until greater linkages are made and speculation as to the causes of the fish tissue concentrations is clearly tied to additions of loadings of mercury from external sources. *(SWCD)*

Response: There is a legal obligation to meet deadlines in a settlement agreement using the best science and information possible, even if there is best professional judgement involved. It appears the commentors would not do anything until more data are supplied. We disagree, we feel that the best science/best information does rise to an acceptable Phase I TMDL. Further, the Phase I TMDL will not result in controls. Rather, controls are more likely to follow Phase II.

4) The margin of safety is intended to address only the uncertainty caused by a lack of information "concerning the relationship between effluent limitations and water quality". This is the uncertainty that Congress felt needed particular attention. Thus, the Margin of Safety should not be used to account for uncertainties in the model assessments, data deficiencies, or the lack of sufficient water quality data. *(FWQC)*

5) .. CDPHE adopted a substantial margin of safety as a "safety net" to offset the myriad uncertainties and lack of data – data which CDPHE intends to gather later. Congress did not intend the margin of safety to serve as a substitute when an agency fails to gather appropriate

supporting data, including the critically important atmospheric mercury deposition data. CDPHE's approach is plainly outside the statutorily designated purpose for a margin of safety, and is thus inappropriate. *(PNW)*

Response: Regarding margin of safety, the plaintiffs in the NY TMDL case brought the issue of MOS up in their complaint. They felt the 10% explicit MOS along with the unquantified implicit MOSs were not adequate to cover the sins of all the uncertainties related to the TMDL. The judge ultimately ruled in EPA's favor on the "BPJ" approach to MOS. In this case, the TMDL approach was almost identical to this one....a phase I TMDL was initially developed/approved with the anticipation that future monitoring would allow adjustments to address the uncertainties related to the phase I TMDL. The CWA requires that a TMDL incorporate "a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality." 33 U.S.C. § 1313(d)(1)(C).

This RESPONSE generally addresses the issues raised in section K:

The Division agrees that there exists a level of uncertainty in the determination of the applicable water quality standard used in this TMDL and subsequent load reductions. The assumptions used to make these decisions, however, are supported by site-specific data in the Reservoirs. With the continued collection of data over time, this uncertainty can be quantified and the TMDL can be adjusted, as needed.

A margin of safety is a required component of a TMDL that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving waterbody. The margin of safety is typically incorporated into the conservative assumptions used to develop the TMDL. The Division believes that the implicit margin of safety used in the development of this TMDL is reasonable given the two time sampling events that were used to characterize mercury in the fish in the Reservoirs and in the model, and that mercury is a persistent, bio-accumulative toxin.

L) Comments related to Air Deposition

1) … existing meteorological evidence indicated that the two identified power plants located to the south of the Reservoirs, including Four Corners, are not upwind of the Reservoirs. *(PNW)*

Response: The average surface wind direction in the summer in this area is expected to be from the south to southwest (Mintz and Dean, An Introduction to Climate, 1968). The nearest 1st order weather station from was Gallup, NM, which is SSE of McPhee. Wind roses are calculated for 1990-1992 (showing compass point from which wind is coming in 10's of degrees). The surface wind at Gallup is predominantly from the southwest with significant fractions from SSE to W.

2) Atmospheric data and analysis are highly uncertain and need significant confirmation. *(SWCD)*

3) The Division states the two stations are not at all similar but then uses the data anyway. Two data points are just enough to develop even a really bad conclusion. We have qualified your use of the data to attempt to reflect these concerns. Therefore, In Section 3-3 in the 4th paragraph under the Section entitled "Atmospheric Loading Estimates", the first sentence should be

amended to read as follows: The estimate of the atmospheric deposition of mercury herein is based on guesswork and is used in an attempt to develop an order-of-magnitude of mercury contribution from atmospheric deposition, not a precise estimate. *(SWCD)*

4) With regard to the first paragraph in Section 7.2.2, please substantiate that the assumptions are reasonable, on what data are they based, and please provide an analysis. *(SWCD)*

5) Atmospheric depositions are assumed to be from coal-fired power plants both within Colorado as well as from far beyond the state's boundaries, despite the acknowledgement that "there are not sufficient data to allocate the atmospheric deposition component to individual sources". Clearly, additional data collection must occur before allocating mercury to any sources, atmospheric or otherwise. Also, the contribution from forest fires is mentioned, but has not been quantified and should be closely measured based upon experience during the wildfire season of 2001. *(CMA)*

6) The Draft Phase I estimated air deposition by using sulfate and nitrate wet deposition data as a surrogate for actual mercury deposition data. This method was used based on the assumption that the chemistry of NO_x, SO_2 and mercury in the atmosphere are similar. However, the best current information suggests that this is not the case. (…) elemental mercury is not easily converted and deposited, and it may travel thousands of miles in the atmosphere before deposition. Consequently, sulfate and nitrate deposition data from regional NO_x and SO_2 releases are not an adequate surrogate for mercury deposition data. *(PNW)*

7) The Draft Phase I uses sulfate and nitrate data to estimate wet mercury depositions. Dry mercury deposition is assumed to be 65% of wet deposition. Support for this critical assumption is not explained, other than reference to "project team experience in other areas". We do not believe that this assumption is sufficient to establish a TMDL for the Reservoirs, and may not even be appropriate for a first order scooping evaluation of mercury deposition. *(PNW)*

8) CDPHE's proposal for a 75% reduction in atmospheric mercury deposition is not supported by the data. *(PNW)*

9) … the technical support document (Tetra Tech 2000) is based on mercury deposition rates from within a range reported from Wisconsin and Minnesota. The document discounts an EPA report to Congress specifically analyzing mercury deposition rates for Southwest Colorado. *(PNW)*

10) The Draft Phase I is inflammatory and prejudicial to Four Corners, and abandons the traditional scientific method. *(PNW)*

11) At a minimum, CDPHE must eliminate the inflammatory and unsubstantiated statements regarding Four Corners: 1) eliminate specific references to the Four Corners Power Plant on page 3-2, third and last paragraph; 2) delete Table 3-1 (Estimated Mercury Emissions from Coal-Fired Power Plants); 3) eliminate assertion that the Four Corners Power Plant is upwind from the reservoirs; 4) remove statement that the power plants are a "likely source" of atmospheric deposition to the San Juan Mountains; 5) delete statements on page 3-5 that the plants "likely contribute to atmospheric deposition loads at" the Reservoirs and "emit a relatively large total mercury load, which is likely to be transported" toward the Reservoirs; and 6) eliminate or revise figure 3-1, because it prejudicially identifies all power plants within 200 miles of the Narraguinnep Reservoir, ignoring the wind patterns. *(PNW)*

Response: The average surface wind direction in the summer in this area is expected to be from the south to southwest (Mintz and Dean, An Introduction to Climate, 1968). The nearest 1st order weather station from was Gallup, NM, which is SSE of McPhee. Wind roses are calculated for 1990-1992 (showing compass point from which wind is coming in 10's of degrees). The surface wind at Gallup is predominantly from the southwest with significant fractions from SSE to W.

Additionally backtrajectory analysis and Hysplit-4 were used to compute air mass trajectories for this area during 2000 by Mark Williams of the University of Colorado and INSTAAR and presented in results from the Telluride AirMon site.

12) We do not believe that the Tetra Tech study has adequately addressed the upwing coal-fired power generating plant emissions' contribution to not only direct mercury loading into the reservoirs themselves, but also as a source in the tributary sub-basins as well. *(WTC&A)*

13) The Public Comment Draft states on page 3-2 that "Significant point sources of mercury often cause locally elevated areas of near-field atmospheric deposition downwind". No references are given to substantiate this claim. In particular, it is not clear what types of sources are being referenced. While studies may be available showing enhanced deposition near certain types of source (such as gold processing facilities, certain smelting operations or chlor-alkali plants), I am not aware of any studies which show enhanced near-field Hg deposition due to coal-fired power plants. Results from on-going studies indicate that much of the HG^{++} from utility stacks is rapidly converted to Hg^0 soon after leaving the stack. These results are based on real-time speciated Hg measurements around coal-fired power plants in the southeast US. These results suggest that coal-fired power plants may not significantly contribute to local deposition because Hg^0 has a long lifetime in the atmosphere (on the order of 1 to 1.5 years). *(PSC of NM)*

14) On pages 3-4 and 3-5 of the Public Comment Draft, it is stated that the San Juan and Four Corners generating stations are "under some meteorological conditions, upwind of the McPhee and Narraguinnep Reservoirs". The Public Comment Draft does not attempt to describe these conditions or quantify their frequency of occurrence. By doing this, it leaves a false impression that such conditions may occur with significant frequency. *(PSC of NM)*

15) On page 3-6 of the Public Comment Draft it is stated that nitrate and sulfate deposition has been used as a surrogate for Hg deposition. This is not a reasonable assumption. It is generally accepted that "reactive mercury" (Hg^{++}) is very reactive and is removed within a short distance (less than 50 miles) of the source. It is also generally accepted that elemental mercury (Hg^0) is non-reactive and may travel great distance (thousands of miles) from the source. Sulfate and nitrate formation and deposition are frequently dominated by reactions that occur at distances out several hundred miles from the source. This difference in behavior indicates that there are fundamental differences in the chemistry and physics of nitrate/sulfate transport and deposition compared to mercury. Therefore, nitrates and sulfates are not good surrogates for mercury. *(PSC of NM)*

16) Page VI – consider softening this statement "These atmospheric loads are enhanced by emissions from coal-fired power plants located south and west of the reservoir", with a "likely to be…" *(EPA)*

17) Page 3-6 – While it is true that power plants emit mercury, we do not have sufficient information to allocate to the specific sources named. Since Four Corners and San Juan are close

to and generally upwind, it is likely that they have a significant contribution. But reducing emissions from these sources in isolation most likely will not achieve a 75% reduction in deposition. Atmospheric dispersion modeling, such as that currently being done at EPA's OAQPS, could identify individual source contributions. Generally, there is an inverse correlation between deposition from a given source and the source-receptor distance. We have found in visibility research in the Southwest that local power plants contribute only about 10% to local sulfate concentrations, the rest resulting from sources scattered throughout the region (e.g., the 11-state West). Mercury may be even more long-distance (even global) transport because of the very low deposition rates of gaseous Hg. To finger-point two or a handful of sources is unsupportable and detracts from the scientific credibility of the document. 75% reduction in atmospheric deposition of mercury will require regional controls; controlling two local sources would get only a small reduction (e.g., 10%). *(EPA)*

18) Page 3-8 - The analysis technique is not described in sufficient detail. As an example, on this page, wet mercury deposition at Buffalo Pass is given as a concentration. However, deposition at Caballo is in flux ($ng/m^2/wk$) units. Having consistent units is needed to assist in the review. Both units (concentration and flux) would be useful. A table comparing deposition measured at Buffalo Pass and Caballo, as well as Pecos River and other sites in the US would be beneficial. This table could also contain the predicted deposition for McPhee and Narraguinnep. Both units should be shown. Should predicted Hg deposition have error bars? *(EPA)*

19) page 3-10 – Apparently an interpolation technique was used to convert the measured mercury deposition at Buffalo Pass and Caballo to an estimate of deposition at the two reservoirs. The algorithm used measured wet sulfur and nitrogen deposition measurements and site elevation. (Although total flux increases with elevation, concentration decreases). This algorithm is not sufficiently explained. How is the interpolation done? Providing equations would be helpful. More importantly, this procedure is base on a number of assumptions which may not be true. Assumption 1: Mercury deposition is distributed similarly to S/N. It is likely that this is not the case because Hg emission distributions will be different from S/N. Other than power plants, there are other significant sources of Hg, S, and N with different S/N/Hg ratios (e.g., smelters for both S and Hg, and motor vehicles for both S and N). Further, some power plants are controlled for S, while others are not, so the S/N/Hg ratio for power plant will vary significantly. Assumption 2: The deposition rates are the same for S, N, and Hg. We know that this is not the case. Wet and dry deposition rates depend on whether the chemical species is in the gas or particulate phase. All particulate may deposit at the same rate, but gaseous deposition rates vary from very high (nitric acid) to very low (Hg?). *(EPA)*

20) Page 4-53 - The atmospheric deposition fraction is 13% here, but something different later (page 5-5). Please explain. *(EPA)*

21) Page 5-1 - Perhaps we missed something earlier in the report, but how were the loading capacities (2.59 kg for McPhee and 39.1 g for Narraguinnep calculated? The same units should be used rather than different ones (kg and g). (The Executive Summary uses grams). An explanation why the atmospheric deposition is such a smaller contributor at McPhee would be helpful. *(EPA)*

22) Page 5-3 – Here and elsewhere, broad and unsupported inferences regarding sources of atmospheric mercury are made. They are not essential to the important thrust of the study, which is that atmospheric mercury must be decreased significantly to meet TMDL (at least for Narraguinnep). Rather than "believed to derive from intermediate-range transport from coal-fired

power plants, coupled with long-range transport from multiple sources", consider wording such as this: "Atmospheric mercury deposition results from mercury sources, such as power plants and smelters, located throughout the Southwest. The influence of an individual source is related to the source's mercury emission rate, the source's proximity to the receptor, and meteorology (e.g., upwind/downwind)". The way the report is worded, one gets the impression that the problem can be fixed by controlling two power plants. *(EPA)*

23) Pages 5-5 and 5-6 – It is not clear how the control requirements for atmospheric and mining areas (75% and 51%) were derived. Were these arbitrary choices, or were they based on a cost effectiveness assessment? It would be helpful to emphasize that atmospheric deposition is a small contributor at McPhee, but a major one at Narraguinnep. *(EPA)*

24) Page 6-3 – It is not clear that a sufficient Margin of Safety (MOS) is built into the calculation. Just considering the atmospheric deposition side of the equation, there probably is a factor of 2 (or more) of uncertainty. While not that important at McPhee, if the deposition at Narraguinnep were twice as big, this would have a large effect on the calculated TMDL there. The uncertainty in deposition centers around (1) the interpolation algorithm (see above comments) and (2) the assumptions about dry deposition amount compared to wet (65%). Should a realistic estimate of atmospheric mercury deposition uncertainty be made? Should this be fed into the calculation of TMDL with sufficient MOS? *(EPA)*

25) As noted by Colorado, the TMDL is based on limited or questionable data in a number of areas. Notably, the Technical Support Document's estimates of mercury wet air deposition are based on wet air sulfate and nitrate deposition data, as no data were available for mercury wet air deposition. But the best current information suggests that the deposition of sulfate and nitrate occur over long distances, measured in hundreds of miles. Reactive mercury, on the other hand, tends to be deposited over short distances, with the bulk of the deposition occurring within 40 miles of the sources. … In short, any connection between sulfate/nitrate deposition and mercury deposition that might justify use of sulfate/nitrate deposition as a surrogate for mercury deposition is highly questionable. *(UWAG)*

This RESPONSE generally addresses the issues raised in section L:

We agree that the surrogate method is of limited value. It may be giving the right answer for the wrong reasons. This is one of the reasons why additional study, including the collection of ambient data is planned. Nevertheless, the intent of the method was to obtain approximate deposition rates. It is reasonable to believe that actual deposition rates at the Reservoirs are within a factor of two or more (higher or lower) than deposition data observed at regional mercury deposition sites. The report acknowledges that there is a high degree of uncertainty with the estimates. In any case, a high level of uncertainty associated with the deposition estimates is not a valid reason to ignore the role of atmospheric deposition in the TMDL. The magnitude of mercury deposition is uncertain and the estimates could be in error by a factor of two or more to either the low or the high side. The TMDL acknowledges these uncertainties and proposes additional data collection and study with respect to atmospheric deposition.

While there has not been sufficient analysis to quantify the deposition contribution from specific sources of air pollution such as individual power plants, it is reasonable to assume that the actual wet and dry deposition rates of mercury in the TMDL are within a factor of two or more (high or low) of the rates that would be found if a more robust study were performed. From a scientific standpoint, it would not be reasonable to assume there is no atmospheric deposition

component. The deposition rates are approximations and are in a range consistent with observed data at other western sites. The TMDL clearly points out the high level of uncertainty associated with the estimated deposition rates. The fact that significant uncertainties exist does not mean that methods are arbitrary and capricious. The TMDL acknowledges that additional monitoring and study are necessary to better understand mercury deposition in southwest Colorado.

The quoted language from the Public Comment Draft is not intended to imply that the power plants are "upwind" with significant frequency. The actual frequency and magnitude of impacts from the power plants on the Reservoirs and associated watersheds have not been determined. Nevertheless, it would be misleading to suggest that the power plants have no impacts on mercury deposition at the Reservoirs. A detailed study focused specifically on mercury chemistry and transport would be needed to determine the contribution from specific sources.

Mercury deposition observations exist at regional sites. The deposition rates in the TMDL are based on the reasonable assumption that deposition rates at the Reservoirs are probably similar to levels observed at Buffalo Pass and Caballo. It is correct that there has been no direct analysis implicating Four Corners. The deposition rates used in the TMDL are intended to reflect local, regional and global mercury sources. Based on the size and location of the Four Corners Power Plant, its plume will impact the Reservoirs and associated watershed under some meteorological conditions. The frequency and magnitude of such impacts have not been determined. In any case, it is reasonable to assume that Four Corners is one of many sources that contribute to mercury deposition. Further study would be necessary before the magnitude of mercury deposition from nearby sources such as Four Corners can be determined.

The mercury emission rates cited in the report are not directly related to the mercury deposition estimates since deposition modeling has not been performed. Thus, the precise level of mercury emissions does not affect the overall conclusions in this case. If atmospheric modeling is performed in the future, then efforts should be taken to ensure that accurate mercury emission rates and credible modeling methods are used. Ideally, any future modeling would involve a detailed modeling protocol where all assumptions could be reviewed by technical experts, representing various stakeholders.

Clearly, under some meteorological conditions, emissions from Four Corners will impact the Reservoirs. The suggestion that Four Corners is "not upwind" of the Reservoirs is based on an oversimplified meteorological analysis. The intent of the language in the TMDL is that Four Corners is upwind of the Reservoirs under "some meteorological conditions". CDPHE acknowledges that the frequency of such occurrences has not been quantified. In addition, the assumptions in the comments based on steady-state meteorology are misleading. The complex terrain the Four Corners area causes complex meteorological conditions. That is, the use of one or more surface (i.e., 10 meter) meteorological towers to infer impact levels from elevated plumes in complex terrain is of questionable value. In addition, other meteorological variables besides wind direction play an important role in the transport and dispersion of air pollutants. The use of non-steady state models with appropriate physical and chemical mechanisms for mercury would be necessary to quantify the actual impacts from Four Corners. Until such a study is done, it is reasonable for CDPHE to conclude that Four Corners, based on its size and location, can "potentially" impact the Reservoirs under some meteorological conditions.

Re: CASTNET at Mesa Verde National Park

The Air Pollution Control Division agrees that it would be misleading to use the CASTNET site to determine plume transport direction during periods where deposition is important. The use of a fine grid meso-scale model would be needed to fully understand plume transport and dispersion. Additional meteorological monitoring sites would also be necessary to help interpret and validate performance of the meso-scale model.

M) Comments related to Phase II or recommendations for future studies.

1) CDOW's concerns relate to any additional biological sampling that may occur and the number of fish and frequency of sampling conducted to assess the dynamics of mercury in the fish communities in order to refine the TMDL. In addition, the CDOW is concerned about any precedence that might be developed to continue biological monitoring once a TMDL is implemented. Finally, the CDOW is interested in the results of this TMDL that may have implications for other reservoirs in the state. *(CDOW)*

Response: The Division is interested and will coordinate all the aspects of Phase II of this TMDL, such as further studies, data needs, analysis and recommendations.

Legend:

1) SWCD -- Southwestern Water Conservation District
2) CMA -- Colorado Mining Association
3) CDOW -- Colorado Division of Wildlife
4) DMG -- Division of Minerals and Geology
5) FWQC -- Federal Water Quality Coalition
6) CFAR -- Citizens for Accountability and Responsibility
7) PNW -- Pinnacle West Capital Corporation
8) APCD -- CDPHE's Air Pollution Control Division
9) WTC&A -- W.T. Cohan & Associates for the Emma Mine
10) PSC of NM -- Public Service Company of New Mexico
11) EPA -- EPA Region 8 – Air Program
12) EJ -- EarthJustice
13) UWAG -- Utility Water Act Group